Computer Science

ANATOMICAL STRUCTURE CLASSIFICATION USING HISTORAM OF SURFACE NORMALS

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Due to the advanced imaging techniques in modern medicine, automatic identification and classification of anatomical structures has become a serious field of research with applications in robot guided surgery, and 3D objects searching techniques within databases. Pose estimation is an important problem lurking inside of automatic structure identification. It involves the estimation of transformation parameters, such as translation and rotation, to bring different object samples into a standard pose, so that the structure information of different samples can be compared and integrated. Researchers have tried to handle pose estimation with methods such as geodesic paths and principle component analysis. Geodesic paths method has a great advantage that it can compute the deformation existing between two objects. The problem with this method lies within calculating the Geodesic paths of both of our objects. The paths are not an easy calculation and if the curves of two objects do not match, our solution does not become the desired solution. Principle component analysis (PCA) possesses advantages in both speed and accuracy when dealing with objects having little structure differences from the reference object, but it may not generate a valid solution when dealing with objects that are significantly deformed or objects with missing structures. We propose to use the histogram of surface normals as the shape signature of an object, and compute the correlations of histograms between object sample and the reference object to determine object orientation. The histogram of surface normals is a nonnegative function over the unit sphere. An adaptive optimization algorithm has been developed for the exhaustive search of the peak location of the correlation over the sphere. The proposed approach automatically eliminates the scaling factor in pose estimation. The experimental results show that the new pose estimation method is faster than the geodesic path method and more accurate than PCA in dealing with largely deformed objects.